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UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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*Ex parte* BJOERN BORUP, MIKE ACHTZEHN, BURKHARD  
STANDKE, and CHRISTIAN WASSMER

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Appeal 2018-002987  
Application 13/580,194  
Technology Center 1700

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Before ADRIENE LEPIANE HANLON, CATHERINE Q. TIMM, and  
N. WHITNEY WILSON, *Administrative Patent Judges*.

TIMM, *Administrative Patent Judge*.

DECISION ON APPEAL

STATEMENT OF THE CASE

Pursuant to 35 U.S.C. § 134(a), Appellant<sup>1</sup> appeals from the  
Examiner's decision to reject claims 1, 3–6, 8–11, 18, 19, and 21<sup>2</sup> under

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<sup>1</sup> We use the word “Appellant” to refer to “applicant” as defined in  
37 C.F.R. § 1.42. Appellants identify the real party in interest as Evonik  
Industries AG. Appeal Br. 1.

<sup>2</sup> Although the Examiner does not list claim 21 when reciting the grounds of  
rejection, the Examiner discusses claim 21 in the body of the rejection.  
Thus, it is clear that the Examiner rejected claim 21.

35 U.S.C. § 103(a) as obvious over Ying<sup>3</sup> in view of Weiss<sup>4</sup> and Twydell<sup>5</sup> and the Examiner's rejection of claims 1, 3–6, 8–11, 18, and 19 under 35 U.S.C. § 103(a) as obvious over Ying, Weiss, and Twydell and adding Hoefler.<sup>6</sup> We have jurisdiction under 35 U.S.C. § 6(b).

We AFFIRM.

#### CLAIMED SUBJECT MATTER

The claims are directed to a process for preparing a thixotropic composition. The process involves mixing two components (i) and (ii) and covalently bonding them together. Component (i) is at least one aqueous, completely hydrolyzed, oligomeric, and organofunctional siloxanol or a mixture of oligomeric, organofunctional siloxanols which is substantially free from organic solvents, wherein each silicon atom of the siloxanol, or mixture of siloxanols, comprises at least one functional group independently selected from the (a) and (b) groups recited in claim 1. We will refer to the component (i) group of compounds as organofunctional siloxanols. Component (ii) is at least one fumed metal oxide selected from a group that includes fumed silica. Claim 1, reproduced below, is illustrative:

1. A process for preparing a thixotropic composition comprising a fumed metal oxide functionalized with at least one oligomeric siloxanol, the process comprising:

mixing:

(i) at least one aqueous, completely hydrolyzed, oligomeric, and organofunctional siloxanol or a mixture of

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<sup>3</sup> Ying et al., US 2009/03054412 A1, published Dec. 10, 2009.

<sup>4</sup> Weiss et al., US 5,645,752, issued July 8, 1997.

<sup>5</sup> Twydell, US 2004/0259836 A1, published Dec. 23, 2004.

<sup>6</sup> Hoefler, US 2006/0178452 A1, published Aug. 10, 2006.

oligomeric, organofunctional siloxanols which is substantially free from organic solvents,

wherein each silicon atom of the siloxanol, or mixture of siloxanols, comprises at least one functional group, said functional group is independently

a) at least one organofunctional group, in an amount of 50% to 100% of functional groups attached to silicon atoms, selected from the group consisting of aminoalkyl, N-alkylaminoalkyl, diaminoalkyl, triaminoalkyl, bis-N-aminoalkyl, bis-N-aminoalkylsilyl, tris-N-aminoalkyl, tris-N-aminoalkylsilyl, quaternary-aminoalkyl, mercaptoalkyl, methacryloyl, methacryloyloxyalkyl, hydroxyalkyl, epoxyalkyl, glycidylloxyalkyl, hydrolyzed glycidylloxyalkyl, polysulfane, disulfane, thioether, polyether, vinyl, alkyl, alkenyl, alkynyl, aryl, alkylaryl, haloalkyl, ureido, sulfanealkyl, cyanate group and isocyanate group, such that the at least one organofunctional group is linear, branched and/or cyclic, and

b) a hydroxyl group, in an amount of 0% to 50% of functional groups attached to silicon atoms, such that remaining free valences of the silicon atoms in the oligomeric siloxanols are filled by hydroxyl groups;

with

(ii) at least one fumed metal oxide selected from the group consisting of silica, metal oxide modified silica, a metal oxide comprising silicon, aluminum, zirconium, titanium, iron, cerium, indium, samarium, tin, zinc, antimony, arsenic, tantalum, rhodium, ruthenium, cobalt, nickel, copper, silver, or germanium, a mixed oxide thereof, and a metal oxide modified therewith; and

covalently bonding the at least one aqueous, completely hydrolyzed, oligomeric, and organofunctional siloxanol or the mixture of oligomeric, organofunctional siloxanols to the at least one fumed metal oxide;

thereby forming the thixotropic composition;

wherein the fumed metal oxide is added as a powder to the aqueous, oligomeric siloxanol or siloxanols and is dispersed with the at least one oligomeric siloxanol and mixed with application of shearing forces at 1,000 to 10,000 revolutions per minute, and

the process is carried out without presence of an organic polymer.

Appeal Br. 10–11.

## OPINION

### *Obviousness over Ying, Weiss, and Twydell*

In arguing against the Examiner's rejection of claims 1, 3–6, 8–11, 18, 19, and 21 as obvious over Ying in view of Weiss and Twydell, Appellant does not argue any claim apart from the others. Appeal Br. 3–8. We select claim 1 as representative for deciding the issues on appeal.

The issue arising is: Has Appellant identified a reversible error in the Examiner's finding that Weiss would have suggested to the ordinary artisan reacting a fumed metal oxide, such as fumed silica, with an organofunctional siloxanol, such as one of those taught by Ying, to form a covalently-bonded thixotropic composition given the teaching of an alternative hydrogen-bonded thixotropic composition of similar chemistry to that of Ying?

Appellant has not identified a reversible error in the Examiner's finding.

The Examiner finds that Ying discloses mixing solvent-free organofunctionalized siloxanol and fumed silica according to the requirements of the mixing step of claim 1. Final 5. Ying discloses that the result is a mechanically reversible gel for 3-dimensional cell culture and

tissue engineering applications. Ying ¶ 58. The origin of the mechanical reversibility (thixotropy) is due to “loose crosslinking” that “may be a physical crosslinking or association, for example due to hydrogen bonding, van der Waals attractions etc.” Ying ¶ 59. According to Ying, applying a sufficient mechanical shear will disrupt the loose crosslinking such that the gel transforms into a liquid state. *Id.*

Appellant contends that covalent bonding is not taught by Ying and is not within the purview of Ying and would be contrary to the gist of Ying. Appeal Br. 6. We agree with Appellant that Ying does not teach covalent bonding, but Ying cannot be considered in a vacuum: The Examiner has also relied on Weiss.

Weiss discloses a magnetorheological material including a mixture of a carrier fluid, a particle component, and a thixotropic additive. Weiss col. 3, ll. 50–54. Weiss discloses that the thixotropic additive can be selected from either a hydrogen-bonding thixotropic agent or a polymer-modified metal oxide. *Id.* Thus, Weiss provides evidence that two types of thixotropic additives were known.

Weiss describes the two types of thixotropic additives at length. The hydrogen-bonding thixotropic agent may be a siloxane-based oligomer with a hydrogen-bonding substituent in a pendant chain or as a terminating group. Weiss col. 4, ll. 46–col. 5, l. 33. The chemistry and hydrogen-bonding mechanisms appear to be similar to those disclosed in Ying and Appellant does not argue otherwise. *Compare* Ying ¶¶ 67–70, *with* Weiss col. 4, l. 46–col. 6, l. 9; Appeal Br. 7–8; Reply Br. 3–5.

Weiss explains that the alternative polymer-modified thixotropic additive is a polymer-modified metal oxide where the metal powder is

reacted with a polymeric compound. Weiss col. 10, ll. 57–62. Weiss suggests the use of the same siloxane oligomers that were previously disclosed for use in preparing the hydrogen-bonding thixotropic additive. Weiss col. 10, l. 64–col. 11, l. 14. In the polymer-modified thixotropic additive, the electronegative substituent-containing group of the siloxane oligomer is covalently bound to the surface of the metal oxide to avoid the presence of any free hydrogen-bonding groups. *Id.* Thus, thixotropy does not occur through hydrogen bonding. Instead, Weiss believes the thixotropic network forms through physical or mechanical entanglement of the polymeric chains attached the surface of the metal oxide. *Id.*

The Examiner finds that Ying teaches the required solvent-less organofunctional siloxanol oligomers and Weiss teaches using the siloxanol oligomers in two different ways. One way results in a hydrogen-bonded thixotropic composition and the other way results in a covalently-bonded functionalized fumed metal oxide. Thus, Weiss would have suggested to the ordinary artisan that the organofunctionalized siloxanes of Ying were useful for functionalizing fumed metal oxide to form a covalently-bonded thixotropic composition.

Appellant contends that the combination of Ying and Weiss is improper because Ying is directed to aqueous compositions for use as a cell culture medium while Weiss is directed to solvent, low water content compositions that use carrier fluids such as mineral oils, etc. Appeal Br. 7–8. But this argument ignores the fact that Weiss includes specific teachings with regard to the thixotropic additive used within the magnetorheological material of the reference. The fact that a carrier fluid and particles are later added does not detract from the teachings specific to the thixotropic additive

itself. Reacting the solvent-less siloxane of Ying with fumed silica in the manner taught by Weiss to form a covalently-bonded thixotropic agent would have been obvious based on the teachings of Weiss, and when using the siloxane of Ying, one of ordinary skill would have reasonably expected to obtain a solvent-less covalently bonded thixotropic composition.

In the Appeal Brief, Appellant does not raise any arguments against the Examiner's findings or analysis regarding mixing at the particular shearing forces recited in claim 1 or the Examiner's use of the teachings of Twydell to support a conclusion of obvious. Appellant merely states that "Twydell is cited to show a range of rpm for shear force and does not cure the deficiency of Ying and Weiss as discussed above." Appeal Br. 8. Appellant presents new arguments in the Reply Brief directed to the Examiner's combination of Ying's teachings with Twydell's teachings. Reply Br. 6-7. But Appellant does not provide a reason why we should consider this argument, which was not raised in the Appeal Brief. Thus, the arguments raised for the first time in the Reply Brief will not be considered here. 37 C.F.R. § 41.41(b).

*Obviousness over Ying, Weiss, Twydell, and Hoefler*

Turning to the rejection of claims 1, 3-6, 8-11, 18, and 19 as obvious over Ying, Weiss, Twydell, and Hoefler, we agree with the Examiner that Hoefler suggests using an aqueous medium that can reasonably be considered "substantially free from organic solvents" as recited in claim 1. Final 10. Hoefler discloses that solvent is optional, that the solvent may be included in low amounts such that the aqueous medium contains from 98-

100% water, based on the weight of the aqueous medium, and refers to this level of solvent as “substantially free of solvent.” Hoefler ¶ 20.

Appellant submits that Hoefler allows for alcohol being formed by hydrolysis of Si-O-R groups and, therefore, Hoefler does not disclose the element of operation (i) of claim 1. Appeal Br. 8. However, there is no evidence of record indicating that the hydrolysis of aminosilane compounds having silicon ester moieties, i.e., the reaction discussed by Hoefler, would provide levels of alcohol sufficient to result in a siloxanol that is not *substantially* free from organic solvent. The word “substantially” allows for some presence of solvent. In fact, Appellant’s Specification regards siloxanol compositions containing up to 5% by weight solvent as substantially free of solvent. Spec. 7. Hoefler teaches solvent concentrations within the “substantially free” concentrations of claim 1. Appellant has not identified a reversible error in the Examiner’s rejection over Ying, Weiss, Twydell, and Hoefler.

#### DECISION

<b>Claims Rejected</b>	<b>Basis</b>	<b>Affirmed</b>	<b>Reversed</b>
1, 3–6, 8–11, 18, 19, and 21	§ 103(a)	1, 3–6, 8–11, 18, 19, and 21	
1, 3–6, 8–11, 18, and 19	§ 103(a)	1, 3–6, 8–11, 18, and 19	
<b>Overall Outcome</b>		1, 3–6, 8–11, 18, 19, and 21	

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FINALITY AND RESPONSE

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a). *See* 37 C.F.R. § 1.136(a)(1)(iv).

AFFIRMED